fectivity of phage T5. Citrate and oxalate ions accelerated the rate of inactivation of phage T5 to an extent which could be explained on the basis of complex formation with traces of divalent metals. The citrate complexes of calcium and magnesium for instance did not protect phage T5 from inactivation as did the metallic ions alone.

The simplest explanation of these results would seem to be that phage T5 can form complexes with a number of cations, and that the infectivity of these complexes is much more stable than that of the free virus.

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The Treatment of Amebic Hepatitis with Chloroquine

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The wartime antimalarial drug research program disclosed a number of highly active 4 aminoquinoline compounds of high activity. It seemed logical to determine whether their antiplasmodial activity extended to other pathogenic protozoa. Because more pharmacological information was available concerning chloroquine, 7 chloro -4- (4-diethylamino -1- methylbutylamino) quinoline, it was decided to test this drug against Endameba histolytica, an infection prevalent in the New York area. Since this drug is localized within the livers of various animals, and presumably man, to some 500 times its plasma concentration, and since only about 8 per cent of the oral dose appears in the feces, it appeared a priori that amebic infection of the liver rather than of the colon would be the test object of choice.

Preliminary results published previously indicated: 1) That chloroquine possesses in vitro activity comparable to that of emetine and superior to that of Anayodin and Carbarsone, 2) That it is more effective in amebic hepatitis than amebic colitis, and 3) that in daily doses of 0.3 gm of the base for two or three weeks no significant drug toxicity occurred.

To date, chloroquine has produced symptomatic and parasitological cure of 16 out of 31 cases of amebic colitis, and a prompt clearing of signs, symptoms and abnormal liver function tests in twelve cases of amebic hepatitis. This report presents detailed observations concerning six of these cases, four of which were studied at the Presbyterian Hospital, one at the Bronx Veterans Administration Hospital, and the other at the Hospital for Tropical Diseases, London, the data of this case being supplied through the courtesy of Drs. F. Murgatroyd and N. H. Fairley. The other 6 cases were studied by Dr. Howard B. Shookhoff of the Tropical Disease Diagnostic Service at the Columbia-Presbyterian Medical Center.

In the 6 cases reported here, 6 had enlargement and tenderness of the liver, 5 had fever of sigfinificant degree (102°F. or higher), Endameba histolytica was demonstrated in the feces of 5 and in pus draining from a liver abscess in one, four had involvement of the right diaphragm as manifested by splinting and pleural effusion. There was abnormal retention of Bromsulfthalein in the four cases in which this test was performed, and elevation of the serum alkaline phosphatase in two of five cases in which it was measured. The cephalin-cholesterol flocculation test was negative in the 5 cases in which it was performed.

Under treatment with chloroquine there occurred in each instance within two to four days definite improvement in all the aspects of the clinical and laboratory pattern. All patients regained their previous health and have maintained it over periods of from 2 to 15 months since discontinuation of therapy.

In two instances a comparison has been

afforded between chloroquine and emetine. In one case emetine produced a favorable but incomplete response inasmuch as one month after there remained low grade fever, enlargement and tenderness of the liver as well as anorexia, nausea and failure to gain weight, within a week of treatment with chloroquine all of these manifestations disappeared. The other is the case of Drs. Murgatroyd and Fairley in which there was a draining liver abscess in the pus of which Endameba histolytica were demonstrated throughout various treatment regimes including emetine parenterally, orally and locally by irrigation. The amebae disappeared from the liver pus on the fifth day of chloroquine treatment and the wound was healed by the twelfth day.

Chloroquine would thus appear to be a safe and effective substitute for emetine in the treatment of extraintestinal amebiasis. Its lack of serious toxic potentialities render it preferable to emetine. When coupled with a superior intestinal antiamebic drug it should permit complete therapy of any amebic infection on even an ambulatory basis if the condition of the patient warrants it.

REFERENCE

1. Conan, Neal J., Jr., Chloroquine in Amebiasis, American Journal of Tropical Medicine, Jan. 1948, p. 427.

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Effect of Nucleic Acids and Carbohydrates on the Formation of Streptolysin S.

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Yeast nucleic acid stimulates the formation of a potent hemolysin in cultures of *Streptococcus pyogenes* (Okamoto, H., Jap. J. Med. Sci., IV. Pharmacol., 1939, 12, 167). The properties of the hemolysin indicate that it is probably identical with streptolysin S. It has been found that little or no streptolysin S is formed in chemically defined-medium cultures unless the medium is supplemented with two other factors. Neither one of these factors is needed for growth but both are required for streptolysin S formation. The chemical nature of each has been elucidated and pertinent information concerning them follows:

The first factor is supplied by ribonucleic acid from yeast, wheat, mammalian liver, or streptococci, but apparently not by ribonucleic acid from tobacco mosaic virus nor by desoxyribonucleic acid prepared from several sources, nor by purine- and pyrimidine-mononucleotides or their hydrolysis products. Fractionation of yeast nucleic acid, following enzymatic splitting, has yielded a polynucleotide whose streptolysin-inducing activity is approximately 100 times that of yeast nucleic acid. The polynucleotide has been partially characterized but knowledge of its exact composition is incomplete.

The other factor is present in peptone and in muscle. It can be replaced by minute amounts of maltose or by somewhat larger amounts of glucosamine or trehalose. As little maltose as M/64,000 is sufficient to cause a significant degree of streptolysin formation. Glucose as well as many other mono-, di- and polysaccharides, are either inactive or active only in relatively high concentrations.

When appropriate concentration of polynucleotide, maltose, and glucose are used, streptolysin S can be produced in a medium the chemical composition of which is essentially defined. Using this information, a satisfactory method of producing streptolysin S in mass cultures has been developed.